

REMARKS

Reconsideration of the above-identified application in view of the preceding amendments and the following remarks, taken in conjunction with the attached supporting Declaration of Richard Bajan pursuant to 37 C.F.R. §1.132 ("Bajan Declaration"), is respectfully requested. Claims 1 and 4-31 remain in this application. Claims 32 and 33 have been withdrawn from consideration as being directed to non-elected subject matter. Claims 2-3 have been cancelled herein without prejudice and Claims 34-46 were previously cancelled without prejudice. Independant Claims 1, 10, 15 and 24 have been amended to more particularly point out and define the subject matter regarded as inventive.

In particular, these claims of been amended to define the microscopic roughness characteristic (i.e., super micro-roughness) of the modified surface of the substrate that promotes the formation of a bond between the substrate and the metallurgical coating layer that is sufficient in strength to support deposition of a coating layer having a thickness in excess of about 0.500 inches. No new matter has been added to the subject application by these amendments, nor have any new issues been raised. Support for the amendments are found throughout the written specification and figures.

CLAIM REJECTIONS

Claim Rejections – 35 U.S.C. §103

Claims 1, 2, 4, 5, 7, 9-11 and 14 were rejected under 35 U.S.C. §103(a) over the Knapp article entitled "Waterjet roughned surface analysis and bond strength" in view of U.S. Patent No. 5,512,318 to Raghavan et al. and EP 0 750 054 to Taylor.

For the following reasons, it is respectfully submitted that the amended claims of the subject application define an invention that is not rendered obvious by the combination of references proposed by the Examiner.

The Knapp article reports plasma sprayed MCrAlY coatings with a thickness in the range of 0.13 mm to 0.38 mm (.005 in. to .015 in), which exhibited a bond strength of about 70-75 MPa (10-12 ksi). In contrast, the claimed HVOF method produced coatings on a water jet prepared surface in excess of 0.500 inches that were nearly forty (40) times thicker than the coatings described in the Knapp article, and enabled the preparation of tensile specimens that exhibited a coating tensile bond strength that averaged 95 ksi, which is nearly nine (9) times the bond strength reported in the Knapp article. (Bajan Declaration ¶12).

The Raghavan patent describes a method of roughening the surface of a substrate prior to application of metallurgical using a high-pressure water jet. However, Raghavan does not disclose the combination of operational parameters necessary to produce a surface morphology on a superalloy substrate that promotes a bond sufficient in strength to support the deposition of an HVOF coating having a thickness in excess of about 0.500 inches. (Bajan Declaration ¶13).

The European '054 Patent to Taylor discloses modification of a substrate surface by a high-pressure water jet prior to thermal spray coating, but fails to disclose whether the modified surface has a microscopic roughness characteristic that promotes a bond sufficient in strength to support deposition of an HVOF coating having a thickness in excess of 0.500 inches. (Bajan Declaration ¶14).

It is respectfully submitted that none of the references cited by the Examiner disclose or suggest the claimed invention. Furthermore, as set forth in the accompanying Bajan Declaration,

the claimed operational parameters for high pressure water jet preparation of a superalloy substrate result in a surface morphology that promotes the formation of a mechanical bond between the substrate and the metallurgical coating that is far superior than previously known in the art. (Bajan Declaration ¶11). Indeed, as noted above, there is nothing in the prior art references cited by the Examiner that suggests either alone or in combination, in whole or in part, a surface treatment method for producing a surface morphology that promotes a bond sufficient in strength to support the deposition of an HVOF coating having a thickness in excess of about 0.500 inches. That result is completely unexpected and is strong support that the claimed invention is unobvious.

For each of the foregoing reasons, the rejection of Claims 1, 2, 4, 5, 7, 9-11 and 14 under 35 U.S.C. §103(a) should be withdrawn.

Claims 6 and 12 were rejected under 35 U.S.C. §103(a) over the Knapp article in view of U.S. Patent No. 5,512,318 to Raghavan et al. as applied to Claims 1, 2, 4, 5, 7, 9-11 and 14 above, and further in view of U.S. Patent No. 5,956,845 to Arnold et al.

As noted above, the Knapp article and Raghavan et al. are deficient with respect to the strength of the mechanical bond formed between the substrate and the metallurgical coating that results from the claimed high pressure water jet preparation. It is respectfully submitted that Arnold et al. do not overcome these noted deficiencies. Indeed, Arnold et al. disclose an HVOF spray process for treating metal components, wherein the coating is built-up to a thickness of approximately .02 inches. (See col. 12, lns. 21-22). Thus, Arnold et al. do not disclose or suggest modifying the surface morphology of the components in a manner that promotes a bond sufficient in strength to support deposition of an HVOF coating having a thickness in excess of

0.500 inches. (Bajan Declaration ¶11). Accordingly, Claims 6 and 12 are not rendered obvious by the combination of references proposed by the Examiner at least for the same reasons stated above with respect to Claims 1, 2, 4, 5, 7, 9-11 and 14, and withdrawal of the rejection is respectfully requested.

Claims 8 and 13 were rejected under 35 U.S.C. §103(a) over the Knapp article in view of U.S. Patent No. 5,512,318 to Raghavan et al., as applied to Claims 1, 2, 4, 5, 7, 9-11 and 14 above, and further in view of WO 02/40745 to Dietrich et al.

As noted above, the Knapp article and Raghavan et al. are deficient with respect to the features of the claimed invention. It is respectfully submitted that Dietrich et al. do not overcome these noted deficiencies. Indeed, Dietrich et al. disclose a method that involves the application of a bond promoting layer of MCrAlY on a substrate by low pressure plasma spray and then applying a ceramic layer of lanthanide pervoskite in a thickness of about 0.3 mm by means of atmospheric plasma spraying. Thus, Dietrich et al. do not disclose or suggest modifying the surface morphology of a substrate in a manner that promotes a bond sufficient in strength to support deposition of an HVOF coating having a thickness in excess of 0.500 inches. (Bajan Declaration ¶17). Accordingly, Claims 8 and 13 are not rendered obvious by the combination of references proposed by the Examiner, for at least the same reasons set forth above with respect to Claims 1, 2, 4, 5, 7, 9-11 and 14, and withdrawal of the rejection is respectfully requested.

Claims 15, 16, 18, 19 and 22 were rejected under 35 U.S.C. §103(a) over the Knapp article in view of U.S. Patent No. 5,512,318 to Raghavan et al. and Taylor's '054 EP application

as applied to Claims 1, 2, 4, 5, 7, 9-11 and 14 above, and further in view of U.S. Patent No. 6,607,611 to Dariola.

As noted above, the Knapp article, Raghavan et al. and Taylor's '054 EP application are deficient with respect to the features of the claimed invention. It is respectfully submitted that Dariola does not overcome these noted deficiencies. Indeed, Dariola discloses a method of depositing a MCrAlX bond coat layer on a substrate, wherein the bond coat layer is preferably from about 0.0005 to about 0.005 inches thick, and most preferably about 0.002 inches thick. Thus, Dariola does not disclose or suggest modifying the surface morphology of a substrate in a manner that promotes a bond sufficient in strength to support deposition of an HVOF coating having a thickness in excess of 0.500 inches. (Bajan Declaration ¶17). Accordingly, Claim 15, 16, 18, 19 and 22 are not rendered obvious by the combination of references cited by the Examiner, at least for the same reasons stated above with respect to Claims 1, 2, 4, 5, 7, 9-11 and 14, and withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

Claims 17, 21, 23-27 and 29-31 were rejected under 35 U.S.C. §103(a) over the Knapp article in view of U.S. Patent No. 5,512,318 to Raghavan et al., Taylor's '054 EP application and of U.S. Patent No. 6,607,611 to Dariola and applied to Claims 15, 16, 18, 19 and 22 above and further in view of U.S. Patent No. 5,956,845 to Arnold et al.

As previously stated, each of the cited references are deficient in one way or another. That is none of the references disclose or suggest, either alone or in combination, in whole or in part, modifying the surface morphology of a substrate in a manner that promotes a bond sufficient in strength to support deposition of an HVOF coating having a thickness in excess of 0.500 inches. Accordingly, Claims 17, 21, 23-27 and 29-31 are not rendered obvious by the

combination of references cited by the Examiner, and withdrawal of the rejection under 35 U.S.C. §103(a) with respect thereto is respectfully requested.

Claims 20 and 28 were rejected under 35 U.S.C. §103(a) over the Knapp article in view of U.S. Patent No. 5,512,318 to Raghavan et al., Taylor's '054 EP application, U.S. Patent No. 6,607,611 to Dariola and U.S. Patent No. 5,956,845 to Arnold et al. as applied to Claims 17, 21, 23-27 and 29-31 above, and further in view of WO 02/40745.

As previously stated, each of the cited references are deficient with respect to the features of the claimed invention. That is none of the references disclose or suggest, either alone or in combination, in whole or in part, modifying the surface morphology of a substrate in a manner that promotes a bond sufficient in strength to support deposition of an HVOF coating having a thickness in excess of 0.500 inches. Accordingly, Claims 20 and 28 are not rendered obvious by the combination of references cited by the Examiner, and withdrawal of the rejection under 35 U.S.C. §103(a) with respect thereto is respectfully requested.

CONCLUSION

It is respectfully submitted that each of the claims now pending in this application, namely Claims 1 and 4-31 are directed to patentable subject matter, and allowance thereof is earnestly solicited.

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Respectfully submitted,



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